ASIA TURBOMACHINERY & PUMP SYMPOSIUM
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# PUMP CAVITATION – PHYSICS, PREDICTION, CONTROL, TROUBLESHOOTING

Short Course

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FLOWSERVE

TURBOMACHINERY LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION

TEXAS A&M UNIVERSITY

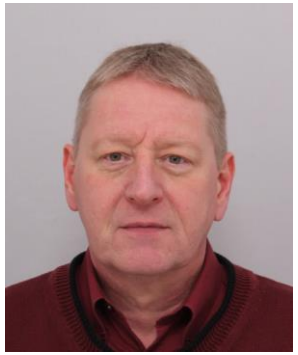
# Biography – Bruno Schiavello

Bruno Schiavello is Research Fellow, Hydraulics, at Flowserve, Pumps Department, in Bethlehem, Pennsylvania, USA and previously served as Director for Fluid Dynamics with Ingersoll Dresser Pump Company, Phillipsburg, New Jersey, since 1993. He started in 1975 with the R&D Department of Worthington Nord (Italy), joined in 1982 the Central R&D of Worthington Pumps, USA, then Dresser Pump Division.

Mr. Schiavello was co-winner of the H. Worthington European Technical Award in 1979. He has written several papers and lectured at seminars in the area of pump suction recirculation, cavitation, and two-phase flows. He is a member of ASME, and former Associate Editor for ASME Journal of Fluids Engineering (two terms). He has received the ASME 2006 Fluid Machinery Design Award, the ASME 2016 Henry R. Worthington Medal, and the ASME Medal and Certificate as Eminent Fluids Engineer at the Celebration of the 90th Anniversary of the Fluids Engineering Division, Washington DC, 2016. Also, he has been Co-Lead Organizer of the ASME International Symposium on Pumping Machinery in 2005, 2009, 2011, 2015 and 2017. He has served on the International Pump Users Symposium Advisory Committee since 1984.

Mr. Schiavello received a B.S. degree (Mechanical Engineering, 1974) from the University of Rome, Italy, and a M.S. degree (Fluid Dynamics, 1975) from Von Karman Institute for Fluid Dynamics, Rhode St. Genese, Belgium.

# Biography – Frank Visser



Frank Visser is Principal Engineer at Flowserve, Aftermarket Services & Solutions, in Etten-Leur, The Netherlands. He joined Flowserve in 1995 (at that time, BW/IP International), where he has held several positions in research, development, and (product) engineering. His key expertise and interests relate to fluid mechanics, CFD and thermodynamics of (centrifugal) pumps and hydraulic turbines, on which he has authored & co-authored multiple technical papers in journals and proceedings.

Dr. Visser obtained a B.S. degree (Mechanical Engineering, 1985) from Technical College Alkmaar, The Netherlands, and a M.S. degree (Mechanical Engineering, 1991) and Ph.D. degree (Technical Sciences, 1996) from the University of Twente, The Netherlands. He has received the ASME 2017 Sankaraiyer Gopalakrishnan-Flowserve Pump Technology Award, is a member of the Royal Netherlands Society of Engineers (KIVI), a member of the Industrial Advisory Board for the J.M.Burgerscentrum (JMBC), National Research School for Fluid Mechanics in the Netherlands, a member of ASME, and former Associate Editor for ASME Journal of Fluids Engineering (two terms).

# Short Abstract

This short course gives insight into roto-dynamic pump cavitation and provides deeper understanding of particulars like cavitation inception, three-percent head drop, 40,000 hours life criterion, cavitation damage potential, NPSHR scaling laws, the effect dissolved gas, and thermodynamic effect for hot water and hydrocarbons. Furthermore, empirical correlations for predicting various types of NPSHR and the use of CFD will be discussed. Moreover, suction specific speed and suction energy will be critically reviewed along with criteria for NPSHA margin. Also the effect of fluid transients and viscosity will be addressed. The cavitation damage potential will be fully explained by the “Cavitation Modes Map”, which reflects fundamental insight gained since the 1940’s; here in particular the striking departure in shape from the NPSH3 curve for part flows is highlighted, being a key reason of many cavitation pump problems. Attention is further devoted to Impeller Life Expectancy and Cavitation Control with modern designs tools. In conclusion, four field case studies will demonstrate the use of cavitation failure analysis and solution strategy.

# Agenda

- **Session 1:**
  - Part A: Introduction to Cavitation
  - Part B: Net Positive Suction Head
- **Coffee Break**
- **Session 2:**
  - Part A: Further Insights & Particulars
  - Part B: CFD of Cavitating Flows
- **Lunch Break**
- **Session 3:**
  - Cavitation Control
- **Coffee Break**
- **Session 4:**
  - Cavitation Failure Analysis (Methodology / Case Studies)

**Tutorial Paper:**
http://oaktrust.library.tamu.edu/handle/1969.1/163898